

REMARKS/ARGUMENTS

Claims 1-20 are pending in the application. The Applicant hereby requests further examination and reconsideration of the application in view of the foregoing amendments and these remarks.

In paragraph 1, the Examiner objects to the drawings. In response, the Applicant has corrected FIG. 2 to change the label "Dykstra" to "Dijkstra," as suggested by the Examiner. A Transmittal of Corrected Drawings including a corresponding replacement sheet is provided herewith. The Applicant believes the foregoing amendment to the drawings to be sufficient to overcome the Examiner's objections thereto.

In paragraph 2, the Examiner objects to the Abstract. In response, the Applicant provides herewith an amended Abstract that has been shortened to fewer than 150 words. The Applicant believes that the amended Abstract overcomes the Examiner's objections thereto.

In paragraph 3, the Examiner objects to the specification paragraph beginning at p. 12, line 12. In response, the Applicant amends this specification paragraph herein, in the manner suggested by the Examiner. The Applicant believes this amendment sufficient to overcome the Examiner's objections thereto.

In paragraphs 4 and 5, the Examiner rejects claim 4 as indefinite under 35 U.S.C. §112, second paragraph. In response, the Applicant amends claim 4 herein to remedy the lack of antecedent basis. The Applicant believes this amendment sufficient to overcome the Examiner's objections thereto.

The Applicant has also amended claim 18 to correct an error therein.

None of the amendments made herein are to overcome any prior-art rejections.

In paragraphs 6 and 7, the Examiner rejects claims 1-6 and 17-20 under 35 U.S.C. §103(a) as being unpatentable over Ashwood Smith, U.S. Patent No. 6,738,354 ("Smith") in view of Goel et al., U.S. Patent No. 6,661,797 ("Goel").

For the following reasons, the Applicant submits that claims 1-6 and 17-20 are allowable over Smith and Goel.

Claim 1 recites, *inter alia*, "generating a graph for the packet network integrating logical and optical layers as nodes and links of the graph, wherein each node of the graph accounts for presence or absence of wavelength conversion within the node." An example of this is illustrated in the graph of FIG. 3, where wavelength conversion is present in nodes N1, N2, and N4. That is, in the model for each of these nodes, a respective "super-node" (N11, N21, and N41) performs a conversion between wavelengths λ_1 and λ_2 . On the other hand, wavelength conversion is absent in node N3, which does not contain a super-node because it does not allow for conversion between wavelengths λ_1 and λ_2 . Thus, for each node, the graph contains both (i) a list of each wavelength that may be used for both incoming and outgoing connections at the node (i.e., each of nodes N1-N4 can use wavelengths λ_1 and λ_2 for both incoming and outgoing connections), and (ii) a list of the available conversions from one wavelength to another at the node (i.e., for each of nodes N1, N2, and N4, if wavelength λ_1 is used for an incoming connection, then either wavelength λ_1 or λ_2 can be used for the corresponding outgoing connection; and, for each of nodes N1, N2, and N4, if wavelength λ_2 is used for an incoming connection, then either wavelength λ_1 or λ_2 can be used for the corresponding outgoing connection).

Quite to the contrary, the graph of Smith does not permit such complex modeling. At col. 3, line 66 to col. 4, line 20, Smith explains as follows:

The present invention provides a technique for label selection for an MPLS end-to-end optical path 16 across the communications network 2 between a source node 10a and a destination node 10b via one or more intervening cross connects 4. The path 16 is divided into hops 18, each of which is served by a respective node (e.g., the source node 10a of a cross-connect 4) connected at the up-stream end of the hop 18. In a WDM (or DWDM) environment, the label assigned to each label switched packet (LSP), for each hop 18, is the channel (wavelength) used for conveying the LSP through the hop. In other words, the label designates the wavelength on which the path 16 traverses the hop 18. In the example illustrated in FIGS. 1 and 3, the source and destination nodes 10a and 10b are located at respective edge nodes, and two intervening cross-connects 4a and 4b are incorporated into the path 16. One or both of the cross connects 4a, b may be non-agile, so that label (thus wavelength) conversion between hops (i.e. within a cross-connect 4) may not be possible. Thus in accordance with the present invention, a common label is selected such that the label switched end-to-end optical path 16 using the common label (wavelength) can be mapped across the communications network 2.

Thus, the model of Smith accounts only for (i) a list of each wavelength that may be used for both incoming and outgoing connections at each node (i.e., each of the nodes can use wavelengths λ_1 and λ_2 for both incoming and outgoing connections, as shown in elements 30, 28a, and 28b of Smith's FIG. 3). However, Smith fails to teach (ii) a list of the available conversions from one wavelength to another at each node (i.e., for each of the nodes, if wavelength λ_1 is used for an incoming connection, then either wavelength λ_1 or λ_2 can be used for the corresponding outgoing connection; and, if wavelength λ_2 is used for an incoming connection, then either wavelength λ_1 or λ_2 can be used for the corresponding outgoing connection, etc.). Thus, if Smith's model were imposed on the network modeled in the Applicant's FIG. 3, the model would indicate that at any of nodes N1-N4, an incoming connection could be at wavelength λ_1 with a corresponding outgoing connection at wavelength λ_1 , or an incoming connection could be at wavelength λ_2 with a corresponding outgoing connection at wavelength λ_2 . Significantly, this model fails to reveal that nodes N1, N2, and N4 are capable of performing a wavelength conversion between wavelengths λ_1 and λ_2 . In fact, the goal of the invention of Smith cited above is not to differentiate between nodes permitting wavelength conversion and nodes not permitting wavelength conversion, but rather, to select a common label for routing across a given path, i.e., to permit the same wavelength to be used from one end of the path to the other end. Smith makes it clear that, by using the same wavelength throughout the entire path, "non-agile cross-connects [i.e., those incapable of wavelength conversion] can participate in the end-to-end path, because it is not necessary to perform wavelength conversions between hops." (Col. 7, lines 4-10.) Accordingly, there is no need in Smith to model whether or not a given node can perform wavelength conversions. However, claim 1 plainly requires modeling so that "each node of the graph accounts for presence or absence of wavelength conversion within the node."

Goel fails to supply the missing teachings. Goel discloses a quality-of-service-based path-selection scheme for achieving a user-specified delay threshold and delay threshold tolerance. (Abst.) Goel makes no mention of optical cross-connects, wavelengths, or even optical devices.

Since neither Smith nor Goel discloses generating a graph according to step (a) of claim 1, neither of these references can possibly disclose step (b), which is "modifying the graph, if necessary, based on the new demand and any previously routed demands" or step (c), which is "determining a route through the modified graph as the path for the new demand."

For these reasons, the Applicant submits that claim 1 is allowable over Smith and Goel. For similar reasons, the Applicant submits that claims 18 and 20 are also allowable over Smith and Goel. Since claims 2-6, 17, and 19 depend variously from claims 1 and 18, it is further submitted that those claims are also allowable over Smith and Goel. The Applicant submits therefore that the rejections of claims under Section 103 have been overcome.

Claims 2 and 3

Claims 2 and 3 are also allowable for their own additional features, none of which are disclosed, taught, or suggested by Smith or Goel, as follows:

Claim 2 recites that each node and link of the graph is present in the graph based on a residual capacity of each wavelength of each optical link. As explained in the specification beginning at p. 12, line 12, "[w]hen a particular wavelength of each link between nodes of the path carries r_d units of the demand, a residual capacity c_r , of $(1-r_d)$ units of bandwidth is available in that wavelength for future demands." Smith merely discloses modeling whether a given wavelength is currently available for incoming and outgoing connections at a given node, but does not disclose modeling residual capacity as units of bandwidth available for future demands. Nor does Goel disclose computing such a residual capacity.

Claim 3 recites that each node is modeled based on whether it is a router, an optical cross-connect (OXC) with wavelength conversion, or an OXC without wavelength conversion, and that each available wavelength of an optical link between nodes is modeled in the graph with a corresponding link in the graph. As discussed above with respect to claim 1, neither Smith nor Goel discloses modeling nodes based on whether or not wavelength conversion exists at that node.

The Applicant submits therefore that the above discussion provides additional reasons for the assertion that claims 2 and 3 are allowable over the cited references.

In paragraph 8, the Examiner indicates that claims 7-16 would be allowable if rewritten to include all of the limitations of the base claim and any intervening claims. However, the Applicant submits that all of the now-pending claims are allowable over the prior art of record and respectfully requests that the Examiner reconsider the pending art rejections in view of the above amendments and remarks.

Therefore, the Applicant believes that the entire application is now in condition for allowance, and early and favorable action is respectfully solicited.

Respectfully submitted,



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